NASA Activities

National
Aeronautics and
Space
Administration

25
25th Anniversary
1958-1983

November 1983
Vol. 14, No. 11

About the Cover

President Reagan joined NASA Administrator James M. Beggs (left) and members of the astronaut corps at a NASA 25th anniversary celebration on Oct. 19 at the National Air and Space Museum in Washington, D.C.

In his remarks, President Reagan praised NASA's accomplishments during the past quarter century: "For 25 years NASA has been the focal point for an activity that is fundamental to the American character: blazing the trail of an exciting new frontier."

He challenged the agency and the rest of America's space community to ". . . aim for goals that will carry us well into the next century."

The President then cut the first slice from a giant 25th anniversary cake.

Astronauts (from the left) are: Capt. Robert L. Crippen, Capt. Frederick H. Hauck, Dr. Steven A. Hawley, Dr. Rhea Seddon, and Dr. Anna L. Fisher. The event was attended by more than 600 NASA Headquarters employees.

Contents

Administrator's Column	3
Astronaut Lousma Retires	4
NASA Studies Effects of Lightning on Aircraft	5
Space Telescope Renamed	6
IRAS Discovers Its Fifth Comet	8
TDRS-1 In Permanent Location	8
Security Office Film Receives Award	8
New System Would Double Capacity of New Communications Satellites	9
AIAA to be Source for Information Database	10
Contractor News	11
What's New in NASA Television and Radio Programming	13
Expendable Launches for 1983	13
Space Shuttle Launches for 1983	13
Patents for Inventions from NASA Research	15
Another Dividend from Air and Space	16

NASA Activities is published monthly by the National Aeronautics and Space Administration for the information of the agency's employees. Contributions and recommendations are solicited from headquarters and field centers, and should be addressed to Editor, NASA Activities, Office of Public Affairs, Code LFD-10, Washington, D.C. 20546. Material submitted for publication cannot be returned.

Distributed free of charge only to current agency employees. Available by subscription via the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Check or money order should be made payable to Superintendent of Documents, GPO. Subscription rates are $20.00/year domestic; $25.00/year, foreign.

Barbara Selby
Code LFD-10
NASA Headquarters, FOB 6
Washington, D.C. 20546
Phone: (202) 755-8348

Administrator's Column

(In this column NASA Activities feature an article by NASA Administrator James M. Beggs. These articles focus on subjects chosen by him that address topics of broad interest to the agency's employees.)

Reform '88

One of President Reagan's prime objectives when he came into office was to reduce the size, cost and red tape of the federal government. In August 1983, he outlined four management initiatives to accomplish these goals.

A vital element of these programs is Reform '88 which focuses on upgrading the management system and processes of the Executive Branch and is coordinated by the Office of Management and Budget. The other three initiatives are: Management Reform, which is aimed at fulfilling the aims of the Civil Service Reform Act of 1978; Federal Field Structure Reform, which affects agency operations outside Washington, D.C., and is designed to streamline operations and improve services at lower cost; and the President's Private Sector Survey on Cost Control, which is designed to investigate and recommend potential savings and management improvements in government.

The Reform '88 projects aim at improving program management; streamlining the processes that control the government's money, information, personnel and property; and attacking fraud and waste. These projects are:

Budget Upgrade

Federal budgeting still involves massive paperwork flow among OMB, agencies, the Government Printing Office, and Congress, and valuable high-level staff time is often wasted on procedural tasks. The past emphasis on developing the flow of accounting data from larger agencies no longer meets the government's needs. The planned reforms are aimed at automating the budget transmission and will speed the flow of data, ease the heavy workload imposed by the current process and allow decision makers increased productive time.

Increased automation of a paper-intensive process will enable all major agencies to submit budgets electronically for FY85, followed by electronic budget printing and tracking through Congress. By 1989 the budget paper flow can be eliminated.

Cash Management

Most agencies are well along toward installing a federal cash management system. Improvements include more use of electronic money transfers, automated collection points, and timely payments of bills.

Credit Management

Debts owed the government will be controlled by computer-driven systems, cross-referencing among agencies of poor risk information, contracting out with private firms to assist in debt collection, and several other related management tools.

Financial System Reform

By January 1984 an interim government-wide financial management information system will be operating until a permanent improved system is in place in 1988.

The need for comprehensive system reform is evidenced by the fact that there are now 332 different accounting systems not tied to the budget system and costing nearly $1 billion to operate. Forty percent of agency accounting systems are not approved by GAO as required by law. Accounting systems are not responsive to modern agency needs, such as debt collection and credit management and cash flow. Sixty percent of budget accounts required reconciliation with differing amounts reported to Treasury. Accounting controls over federal property are lax.

Administrative Process Cost Reductions

Uniform Productivity Standards will be applied and automation increased in payroll, personnel, and processing for payments and receipts, claims, procurements, and travel. Unnecessary publications will also be reduced further.

Over the next five years $22 billion in upgrades are planned by agencies. Until now, these were largely without coordination among agencies. OMB recently required 20 major agencies to report all planned upgrades of more than $2.5 million to enable coordination, sharing of benefits, and integration into the budget process.

Maximum cost standards will be set for administrative processing, and restrictions have been put on agencies' noncompetitive procurements.

Data Link/Management Information System (MIS)

An existing electronic data link between the Executive Office and major agencies will be expanded to become a full-scale electronic communication system. It will be used for quarterly performance tracking of the President's Private Sector Survey on Cost Control recommendations, Reform '88 and a test MIS.

Automatic Data Processing/Telecommunications

OMB's Office of Information and Regulatory Affairs will concentrate on Federal information management policy and planning and mission-critical system reviews to strengthen data processing financial controls, exploit microcomputer technology, and improve software management.

An historical lack of effective planning by agencies in information management policies and systems has produced a plethora of incompatible systems;

- 18,732 computers at 4,477 sites, up to 11 per cent more than 15 years old.
- 95 percent of software is developed in-house, and therefore more expensively, versus less than 60 per cent in the private sector.
- Traditional resource management has inhibited use of newer, low-cost, high-powered and user-controlled technology.

OMB will concentrate on federal information management policy and planning and mission-critical system reviews—that is, review of systems that are unique to and support the line or program activities of an agency. These systems account for the greatest portion of the federal information technology dollar—tens of billions of dollars annually.

Prevention of Waste, Fraud and Abuse

This effort will include increased use of modern technology, including computer screening, audits, and matches, as well as enhanced existing measures, such as pre-award screening for all loans, loan guarantees, grants and contractors; debarment or suspension of contractors and other recipients, and tighter internal control systems.

The President actively supports implementing these initiatives. OMB is coordinator and catalyst for Reform '88, working closely with the agencies' heads of management.

A review of agency-specific management issues has been incorporated into the budget process as a technique to advance the timing and effect of a broad range of management improvement initiatives. By injecting a budget dimension into implementation of management changes, there is increased assurance that the President's initiatives are institutionalized in agencies' practices and structures.

NASA is committed to the Reform '88 program and is in the forefront in many areas. As in all changes of this sort, there are many problem areas, and we are attacking them vigorously. We are, after all, a problem-solving agency.

We all take pride in the reputation NASA enjoys as a well-managed organization; a reputation earned through open evaluation of the processes used in attaining our goals and objectives. With the active participation of every NASA employee, from clerk to administrator, we hope to make NASA a leader in this administration's goal of a better managed government—more cost conscious; less vulnerable to fraud, waste, and abuse; fairer to all taxpayers; able to use the most modern technology to manage the largest organization in the world; and less expensive.

Astronaut Lousma Retires

Astronaut Jack R. Lousma left NASA on Oct. 1, and will retire from the U.S Marine Corps.

Lousma was commander of the Space Shuttle orbiter, Columbia, on its third test flight in March 1982. He has been a NASA astronaut since April 1966, and served as pilot on Skylab 3 from July 28 to Sept. 25, 1973. He was a backup crewman for the Apollo-Soyuz flight, and was a member of the Apollo 9, 10, and 13 support crews.

He has been a Marine Corps officer since 1959, and will retire in the grade of colonel effective Nov. 1.

With regard to post-retirement plans, Lousma is evaluating a number of alternatives both in and outside the aerospace industry. For the immediate future, he and his family will continue to reside in the Houston area.

NASA Studies Effects of Lightning on Aircraft

After more than 700 storm cloud penetrations and 400 direct lightning strikes to a specially-instrumented jet airplane, scientists at NASA's Langley Research Center, Hampton, Va., are beginning to understand more about lightning at flight altitudes and how it affects aircraft and aircraft flight.

Today's airliners are struck by lightning more than 2,000 times each year or about once per airline aircraft, with little effect. These aircraft are protected by their aluminum skins, which are natural conductors, and by the use of mechanical-hydraulic control systems which are immune from the electromagnetic effects of lightning.

Future aircraft skins, however, may be made of composite materials, which are nonconductors, and may need some form of additional protection from lightning. Lightweight composite materials—woven fibers impregnated with epoxy resins—promise a substantial saving in fuel expenditures and reduced operating costs.

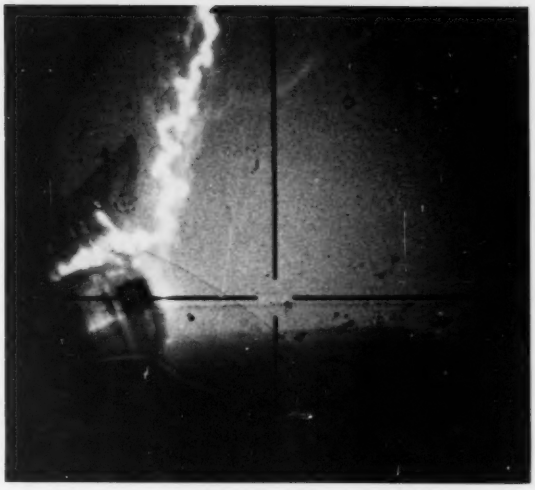
Future aircraft also will use electronic control systems and digital avionics systems for improved flight efficiency and further savings of weight and fuel. However, lightning protection techniques need to be defined to avoid possible damage or upset to these low-voltage, highly sensitive electronic systems.

It had been generally accepted that lightning activity was concentrated in a narrow altitude range where the air temperature is at or near the freezing level. Aircraft that encountered storms were usually advised to fly above this level—above 4,600 meters (15,000 feet).

Recent aviation articles have suggested that pilots avoid flying in temperatures between 0 and –5 Celsius (32 and 23 Fahrenheit) when the atmosphere is electrically charged. Records kept on lightning strikes to aircraft indicate that this is where most strikes occur.

This information can be misleading, however, as explained by Langley's Norman Crabill, Storm Hazards project manager. "Most strikes occur at low elevations (3,050 to 4,600 m—10,000 to 15,000 ft.) because there is a lot of traffic there and deviations around storms are restricted by air traffic control and the need to depart or approach the runway locations. At higher altitudes (7,600 to 9,150 m—25,000 to 30,000 ft.), deviations around the storms are the rule and, hence, there is less exposure to the hazard."

Flights by the Storm Hazards F-106B into thunderstorms at various altitudes indicate that, although some lightning strikes at lower altitudes may be stronger and pack more punch, lightning strikes at higher altitudes seem to occur more frequently.



At left, a bolt of lightning races down the left side of the Langley F-106B fuselage, after striking the nose boom, and exits at the tail before turning upward. The ultra-wide-angle lens of the motion picture camera mounted on the fuselage just above the left wing, distorts the proportions of the airplane. The grey surface at upper left is the vertical tail, the grey area at bottom, the left wing. The strike occurred at an altitude of 28,000 feet over Nags Head, N.C. on June 18, 1982.

In 1980 and 1981, flying near the freezing level, the aircraft took "only" 10 hits each year. In 1982, flying at higher altutudes, Crabill's team logged more than 150 direct hits. In the 1983 storm season, flying at these same higher altitudes, the team reports more than 226 direct strikes to the airplane.

Langley researchers are also learning more about the fundamental characteristics of lightning, perhaps the single most important element of the Storm Hazards program. The physics of lightning has been studied for years by many scientists, but relatively little is known about lightning at typical operating altitudes of airliners.

Felix Pitts of Langley's Fault Tolerant Systems Branch is principal investigator for the Direct Strike Lightning Experiment, which can record more than one million individual measurements of the characteristics of each lightning strike.

Though much is yet to be learned about the internal micromechanisms of lightning, Pitts has already reported significant findings. "Current rates of rise that approach 100 billion amperes per second have been recorded on the F-106B nose boom, for example. Such data," Pitts says, "will be used by the technical

community in establishing updated lightning protection criteria for aircraft."

Research in the Storm Hazards program at Langley and NASA's Wallops Flight Facility, Wallops Island, Va., is proceeding on a broad front, looking at all aspects of lightning pertaining to aircraft flight. The F-106B airplane also collects data supporting research studies of turbulence, wind shear, heavy rain effects and other storm factors.

For the rest of this thunderstorm season and at least one more season, the craft will continue to be flown purposely into selected thunderstorms with the intent of being struck by lightning—all in the interests of safe, efficient flight.

Research pilots fly the Langley F-106B into thunderstorms, hoping to get struck by lightning. Though 25 years old, the F-106B is fast and rugged, making it an ideal airplane for lightning studies.

Space Telescope Renamed

The Space Telescope, America's future orbiting optical astronomical observatory scheduled for launch aboard the Space Shuttle in 1986 has been renamed the Edwin P. Hubble Space Telescope in honor of one of the nation's foremost astronomers.

Hubble's astronomical research over three decades profoundly changed our understanding of the basic structure of the universe.

Before Hubble, scientists held differing views on the extent and dimensions of the universe. It was believed that our solar system was part of a larger system which contained all the stars visible to the naked eye. Astronomers were uncertain whether the faint spiral nebulae were also part of our Milky Way system or themselves distant universes each composed of countless stars.

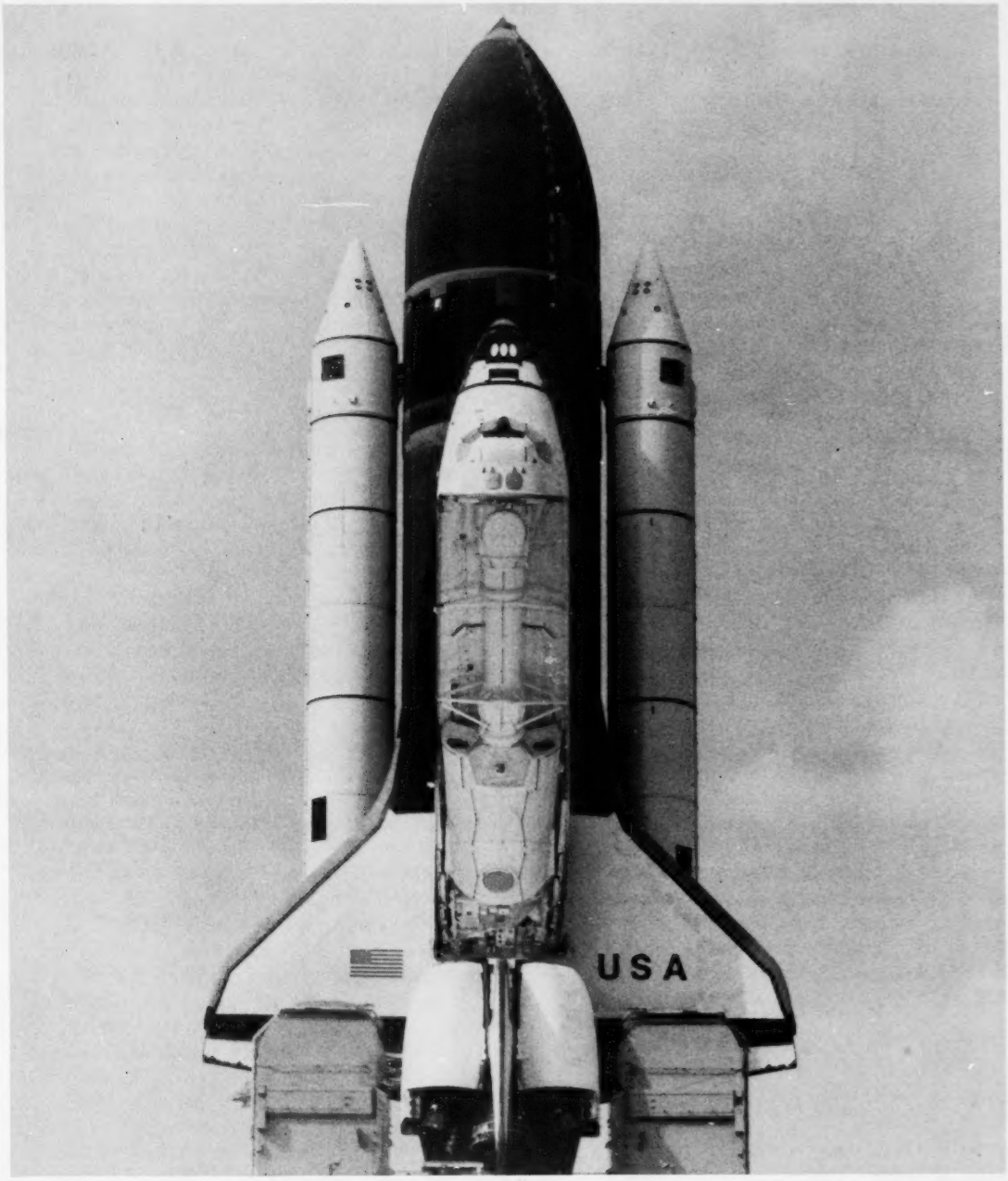
Working at the 100-inch telescope at Mount Wilson, California, Hubble succeeded in observing individual stars in the Andromeda nebula. By the end of 1924, he thus was able to show that Andromeda was many times more distant than any star within the Milky Way system. By means of similar observations of other nebulae, Hubble established that these nebulae were in fact galaxies far beyond our system.

Equally important was a later discovery by Hubble and his assistant, Milton Humason, that the universe was expanding, providing the basic evidence of the Big Bang theory. Their observations showed that external galaxies were traveling away from us, and, the more remote the galaxy, the faster it moves. This phenomena is known as Hubble's Law and the coefficient relating the distance and the velocity of the galaxy is called the Hubble constant.

Hubble was an active research scientist until his death in 1953.

The Hubble Space Telescope will be operated much like a ground-based observatory. The 94.5-inch (2.4-meter) telescope and five scientific instruments will be housed in the space observatory configuration in orbit while spacecraft command, control and scientific operations will be ground based. The observatory, which will not have any interference introduced by earth's atmosphere, will be able to look into space seven times farther than any ground-based observatory, and its imaging will have 10-20 times better resolution. Thus, the Hubble Space Telescope offers the potential of making new cosmological discoveries, in the spirit of its namesake.

NASA Headquarters in Washington, D.C., is responsible for the overall direction of the program; Marshall Space Flight Center in Huntsville, Ala., has responsibility for overall project management including development of the Optical Telescope Assembly and Support Systems Module; Goddard Space Flight Center in Greenbelt, Md., has responsibility for spacecraft operations and scientific instrumentation development; and the Space Telescope Science Institute in Baltimore, Md., has responsibility for managing the scientific investigations and the dissemination of scientific results.



SEE-THROUGH SHUTTLE—What appears to be an X-ray photograph shows the European Space Agency's Spacelab installed in the Space Shuttle Columbia's cargo bay as if the craft's cargo bay doors were removed. The photograph was produced by a double exposure technique by Klaus Wilkens of Technicolor Government Services, Inc. Wilkens first photographed the Spacelab during checkout and processing, then marked the image location in the viewfinder. Weeks later, when the Columbia was rolled to the launch pad, he re-exposed the same frame of film with the viewfinder precisely positioned to superimpose the images.

IRAS Discovers Its Fifth Comet

The Infrared Astronomical Satellite (IRAS) has discovered its fifth comet, and enabled its future position to be predicted without the aid of optical telescopes.

IRAS is an international satellite developed and operated by NASA, the Netherlands Agency for Aerospace (NIVR) and the United Kingdom's Science and Engineering Research Council (SERC).

On July 28 the IRAS comet searching team, at the Preliminary Analysis Facility, Chilton, found what they believed was a faint comet, at very southerly declination. Unfortunately there are few telescopes suitable for confirmation of IRAS candidates in the Southern Hemisphere and bad weather prevented the object's being observed.

Five weeks later, on Sept. 2, a similar object was detected and Dr. John Davies realized that it was possibly a second scan of the July 28 object. A quick calculation of the object's motion supported the belief that the two detections could be a new comet, so the positions were communicated to the Smithsonian Astrophysical Observatory (SAO), Cambridge, Mass.

The observatory confirmed that all the detections fitted a parabolic orbit, typical of long period comets. An ephemeris was calculated from the IRAS data predicting the position of the object several weeks ahead and sent to other smaller telescopes. These telescopes are not suitable for confirmation of faint IRAS objects unless predicted positions are available, reducing the area which must be searched.

On Sept. 11, using the predicted position, Alan Gilmore and Pamela Kilmartin at Mt. John Observatory, New Zealand, identified the faint new comet and it was designated Comet IRAS 19830. This is the first time a comet has been discovered, and its orbit successfully predicted, using data from an astronomical satellite. The new comet will pass closest to the sun in November, but even then it will be outside the orbit of Mars, so it will not be visible to the naked eye.

19830 is the third comet fainter than 17th magnitude discovered by IRAS. The experience gained during the search at the Preliminary Analysis Facility will allow other faint comets to be identified during final data processing at NASA's Jet Propulsion Laboratory, Pasadena, Calif., which in turn will enable better estimates of the total number of comets to be made. A detailed understanding of the comet population is important to theories of the formation of the solar system, and the evolution of the planets.

TDRS-1 In Permanent Location

Engineers from NASA, TRW, and SPACECOM conducted two maneuvers successfully Oct. 16 and 17 to place the TDRS-1 communications satellite in its permanent location at 41 degrees west longitude.

The satellite, launched last April from the Space Shuttle, is now located over the Atlantic just off the northeast coast of Brazil along the Equator.

The communications satellite, built by TRW and owned and operated by SPACECOM, which leases it to NASA, did not reach geosynchronous orbit after its deployment from the Shuttle due to a malfunction in the Inertial Upper Stage booster rocket. Following nearly two months of delicate maneuvering in which only six one-pound thrusters were used, the spacecraft was placed into geosynchronous orbit on June 29 at 67 degrees west longitude.

The maneuvers to move the spacecraft from 67 degrees west longitude, where radio interference is best for testing communications equipment, to 41 degrees began last Sept. 23, when the thrusters conducted two burns. The satellite has been drifting toward 41 degrees since that time.

The Oct. 16 burn of 15.4 minutes, started at 7:18 p.m. EDT. The Oct. 17 burn of 16.8 minutes started at 7:18 a.m. EDT. The two maneuvers were designed to stop the drift, stopping the spacecraft at its desired location.

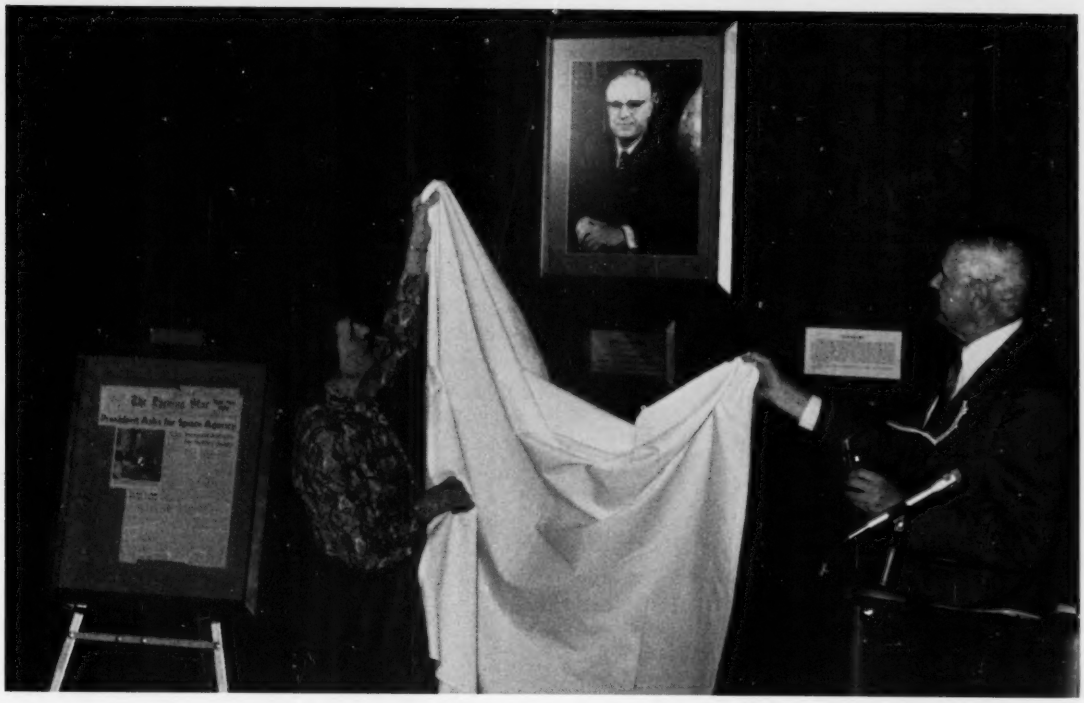
Security Office Film Receives Award

The NASA Headquarters Security Office, competing against 48 entries won a Distinguished Achievement Award (second place) in the 1983 Film/Video/Slide Government Category sponsored by the American Society for Industrial Security in September.

"Space for Security," a 29-minute film to promote security awareness, stresses individual responsibilities of NASA employees to safeguard the national security information entrusted to them.

The film, developed for use in the NASA-wide Security Awareness Program, is one of several security education measures designed for NASA to meet the requirements of Executive Order 12356 on "National Security Information."

The film is being distributed for viewing at NASA centers and installations.



GODDARD LIBRARY RENAMED—NASA Administrator James M. Beggs and Mrs. Homer E. Newell unveil a photograph of the late Dr. Homer E. Newell, former NASA Associate Administrator for Space Science and Applications. The unveiling occurred Sept. 27 during dedication ceremonies at Goddard Space Flight Center, Greenbelt, Md. Goddard's library was renamed in honor of Dr. Newell.

New System Would Double Capacity of New Communications Satellites

The number of channels on a communications satellite could be doubled using a new amplifying system developed by Dr. Henry G. Kosmahl, an electron physicist at NASA Lewis Research Center in Cleveland.

The new system—termed a Dynamic Velocity Taper (DVT)—is actually a relatively minor technical modification of an existing space amplifier. It was designed with the aid of sophisticated computer programs developed in connection with ongoing Lewis efforts to develop, build, launch and operate experimentally advanced communications technology satellites by the mid-80s.

Most nations in the world, including the United States, are seeking additional service from communications satellites for voice, picture and data transmissions. But the closest that such satellites can be spaced around the globe at the geosynchronous orbit level is two degrees; otherwise the signals from one satellite would interfere with an adjacent satellite. Hence, the number of satellite positions available is fixed and limited, and by the year 2000 the full quota of slots is expected to be in use.

"The way out of the jam is to make each satellite able to handle more traffic without affecting the quality of the signals," says Dr. Kosmahl, head of the Lewis Microwave Amplifier Section. "Also important is that you do this without having to increase the power supply."

He explains what happens technically when the Dynamic Velocity Taper is used.

"A stream of electrons is directed from an amplifier. Over a certain length they interact with a radio wave. In the process a part of the energy of the electron is transferred to the wave. The wave carries the signal of communication—voice or whatever—that you want to amplify or strengthen.

"Since the electrons become slower as they proceed, we put a weak wave and strong electron beam at the beginning. We end up with a strong wave and a weak electron beam. To illustrate, imagine auto traffic on an uphill street. Traffic lights are set for a speed of 35 mph. But the cars slow as they go uphill and cannot keep pace to catch all the green lights.

"What we have done with the DVT is similar to readjusting the traffic lights so that, despite the cars' slowdown, they always catch green lights to keep moving. We simply match the speed of the lights to the flow of the cars."

Dr. Kosmahl emphasized that the dynamic transfer of power from the electrons to the radio wave is synchronization is that key feature of the development. A major side benefit is that additional power results from the constant resynchronization.

In the DVT system, power out is charted vertically on a graph while power in is measured horizontally. Normally, without the DVT, the resulting graph is a regular curve, dipping as it moves to the right. The objective is to raise the curve to a straight, slanted line which is called "linear power." This bends to a horizontal line well above the normal curve.

Computers enabled the Lewis scientists to measure and determine exactly how much "lift" is needed each time to raise the normal power curve up to the linear diagonal that produced more power and therefore is able to accomdate more communications traffic.

The point where the linear diagonal bends to horizontal is called the "hard limiter" which has been a goal and objective of physicists for many year's and through many attempts.

Hughes Aircraft's Electron Dynamics Div. at Torrance, Calif., is already using data furnished by Lewis to test the new device and is reporting early success, including obtaining 30 percent more power just by rearranging the "hard limiter" characteristics.

AIAA to be Source for Information Database

NASA has arranged to make bibliographic data containing descriptions of more than 1.2 million reports and articles covering the world's aeronautical and space literature since 1962 available for leasing through the American Institute of Aeronautics and Astronautics (AIAA) located in New York.

Regularly updated with about 70,000 document citations each year, this computer-readable database is the most comprehensive aerospace database available directly to United States organizations. It can be leased by domestic organizations from AIAA for access only within the United States. There are an estimated 200,000 end-users whose work can benefit from the sophisticated technology documented in this system.

The electronic data, to be known as the Aerospace Database, is a combination of the existing abstract periodicals—Scientific and Technical Aerospace Reports (STAR) and International Aerospace Abstracts (IAA). It will be licensed to online vendors and leased to domestic corporations for use in their inhouse database systems. With this new arrangement, all domestic organizations will have direct access to primary aerospace information, supplementing the access already available through NASA's online system, RECON, and through NASA-supported Industrial Application Centers and State Technology Centers.

AIAA will undertake a national marketing effort, not only to reach information intermediaries, but to train scientists and engineers to search the database directly. The objectives of this program will be to:

- Increase utilization of information contained in the printed versions of STAR and IAA;
- Supplement existing online access to the NASA database already available to NASA and other government organizations, to their contractors, and to universities with aerospace programs;
- Enhance the non-aerospace technical community's access to NASA-generated technology; and,
- Make greater use of private-sector capabilities for dissemination of government-sponsored information.

AIAA and NASA have shared in design and production of the database since 1963 when NASA began supporting AIAA's preparation of IAA and adding it to the NASA database. IAA covers world-wide aerospace conferences, books, and journal literature, while STAR covers principally government-sponsored reports and conference proceedings.

GALAXY B LAUNCH—The second in a series of three satellites, Galaxy B is launched from Pad 17A at 6:16 p.m. Sept. 22, 1983, on a Delta rocket. The satellite, owned by Hughes Communications, carries 24 operating transponders, which will be sold or leased to businesses for their use.

Contractor News

Marshall Space Flight Center, Huntsville, Ala., has awarded **United Space Boosters, Inc.** of Huntsville, a $248.9 million follow-on contract for work related to the Space Shuttle solid rocket boosters. The contract encompasses the manufacture, refurbishment, assembly and checkout of the boosters for Shuttle flights 9 through 16. It does not cover the solid rocket motors, which are under separate contract to Morton Thiokol, Inc. The booster contract is a follow-on to NASA's original 1976 contract with United Space Boosters.

Raytheon Service Co., of Burlington, Mass., has been selected to negotiate a cost-plus-award fee contract for logistics mission support at Goddard Space Flight Center in Greenbelt, Md. Terms call for a basic performance period of one year with a one-year first option and three one-year soft options, plus a separate one-month phase-in contract. Total estimated cost for the basic one-year contract and first option is approximately $45 million. The contract provides for institutional supply support to Goddard and NASA Headquarters; logistics support to the Spaceflight Tracking and Data Network, the Tracking and Data Relay Satellie System, the Deep Space Network, the Laser Tracking Network, the NASA Comminications System, NASA control centers and associated activities, and various transportation and traffic management services to Goddard.

Kennedy Space Center, Fla., has awarded **Boeing Services International Inc.** (BSI) of Kennedy Space Center, Fla., two contract extensions in support of the Shuttle Processing Contractor's transition period. One contract is for supply and transportation services and the other is for ground support operations. The supply and transportation contract, initiated Oct. 1, extended through Oct. 31, 1983. The dollar value of the one-month contract is $2,532,269, bringing the cumulative value of the parent contract to $80,361,823. Terms of this contract called for BSI to manage and perform supply support operations and services, transportation management and planning, and purchasing support for these operations.

The contract extension for ground support operations, valued at $6,429,823 was initiated Oct. 1 and extends through Nov. 30, 1983, bringing the cumulative value of the parent contract to $337,856,876. Under this contract, BSI provides facility and utility operations and maintenance, including doors and platforms, elevators, cranes, service shops, miscellaneous electrical and mechanical systems, and water deluge and distribution systems in support of Shuttle related operations.

In further contract news from Kennedy Space Center:

Planning Research Corp. (PRC) of McLean, Va., was awarded a new contract valued at $37,692,455 to provide engineering services for the Directorate of Engineering Development at Kennedy and at Vandenberg Air Force Base, Calif. The cost-plus-fixed-fee contract, initiated Oct. 1, will extend through Dec. 31, 1985. Under terms of this contract, PRC is responsible for designing ground support systems for the Shuttle Centaur program. The Shuttle Centaur will be used to inject space vehicles into an interplanetary trajectory after deployment from the Space Shuttle.

Computer Sciences Corp. (CSC) of Falls Church, Va., was awarded a $3,966,807 one-month extension on its communications and instrumentation services contract in support of the Space Shuttle program at Kennedy. The cost-plus-award-fee contract, for the period Oct. 1 through Oct. 31, 1983, called for CSC and its subcontractor, the RCA Services Co., Cherry Hill, N.J., to provide support in the areas of communications, measurements, telemetrics, instrumentatio of the Launch Control Center firing rooms and reliability and quality assurance programs.

International Business Machines Corp. (IBM) of Cape Canaveral, Fla., has been awarded an addition to an existing contract for systems engineering and software development services in support of the Space Shuttle Processing System. The cost-plus-award-fee contract addition is valued at $3,285,200, bringing the total value of the original contract to $91,637,404. This contract addition, initiated in April 1983, will extend through Sept. 30, 1984. The Launch Processing System is used to automatically control and perform much of the Space Shuttle vehicle checkout while the vehicle components are being prepared for launch. The system ultimately conducts countdown and launch operations.

Westinghouse Electric Corp. of Pittsburgh, Pa., has been awarded a $2,730,285 contract to provide critical hardware for Space Shuttle launch operations. Westinghouse will provide, install and test a Payload Ground Handling Mechanism to be used in the Payload Changeout Room of Launch Complex 39B. Under the fixed-price contract, Westinghouse will deliver the mechanism within 450 days of the Oct. 7 contract award date. The mechanism is highly adaptive to support structures, access platforms and servicing devices which allow satellites and other payloads to be loaded directly into the Space Shuttle's cargo bay at the launch pad. Launch Complex 39B, the second of two Space Shuttle launch pads to be converted from their Apollo-era configurations, is being readied to support the high frequency of launches already scheduled over the next decade.

Kennedy Space Center and **BAMSI, Inc.** of Titusville, Fla., have signed a $1,505,016 contract for BAMSI's first two years as base operations contractor at NASA's Space Transportation System resident office at Vandenberg Air Force Base, Calif. The award, one set aside for a disadvantaged firm, is the largest single award the agency has made to a minority firm, including options contained in the contract, during Fiscal Year 1983. The contract covers such functions as administrative services, facilities, graphics and technical operations in the instrumentation and communications areas. The cost-plus-award-fee contract will be for an initial period of two years, covering the period Oct. 1, 1983, through Sept. 30, 1985. Included in the contract is a one-year option for 1986 valued at $863,601, and two one-year unpriced options for 1987 and 1988.

Ivey's Steel Erectors, Inc., of Merritt Island, Fla., has won a $1,466,288 contract with NASA to provide a solid rocket booster paint facility at the Cape Canaveral Air Force Station. The award is one set aside for a small business firm. The fixed-price contract calls for Ivey's Steel Erectors to build the foundation for and install the pre-engineered building, and to perform all mechanical work associated with the erection of the facility.

Cometto Industriale, SPA, Cueno, Italy, has been awarded a $1,302,308 contract in support of the Space Shuttle program. The fixed-price contract, covering the period Oct. 1, 1983, through Oct. 31, 1984, calls for Cometto to design, develop and manufacture a giant transporter which will be used in Space Shuttle operations at Vandenberg Air Force Base, Calif. Once the transporter is built, Cometto will also be responsible for the training of Air Force and contractor personnel in the operation and maintenance of the transporter. NASA provided the basic configuration design. Cometto will complete the design details for the transporter, which will carry the Shuttle orbiter, with payloads installed, on the 17-mile trip from the North Vandenberg Maintenance and Checkout Facility to the launch pad located on Sound Vandenberg. The transporter will be the first of its kind ever developed. Because it must travel across the hilly California terrain and cross a portion of highway on its journey to the launch pad, it will be different from the six-million pound crawler/transporter used in Shuttle operations at Kennedy. The carrier will be built so that the orbiter can be mounted to the bed of the transporter in a horizontal position.

What's New in NASA Television and Radio Programming

Programs released in October:

Television
Ear on the Universe (4½ minutes plus 90-minute versions)

Radio
Space Story (4½-minute programs)
Open Scissors in the Sky (featuring Tom McMurtry, Ames Research Center)
Shuttle Imaging Radar (featuring Dr. Charles Elachi, NASA Jet Propulsion Laboratory)
Red Giants, White Dwarfs and Supernova (featuring Dr. Leo Goldberg)
Advanced X-ray Astrophysics Facility (featuring Carroll Daily)

Special Report
Solving the Mystery of Quasars (14½-minute program featuring Dr. John Scott, University of Arizona

Copies of television tapes are sent simulanteously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite RCA-Cablenet 1. Five hundred television stations receive formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot"—a condensed version of the 4½-minute presentation.

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Release each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes released quarterly.

Expendable Launches for 1983

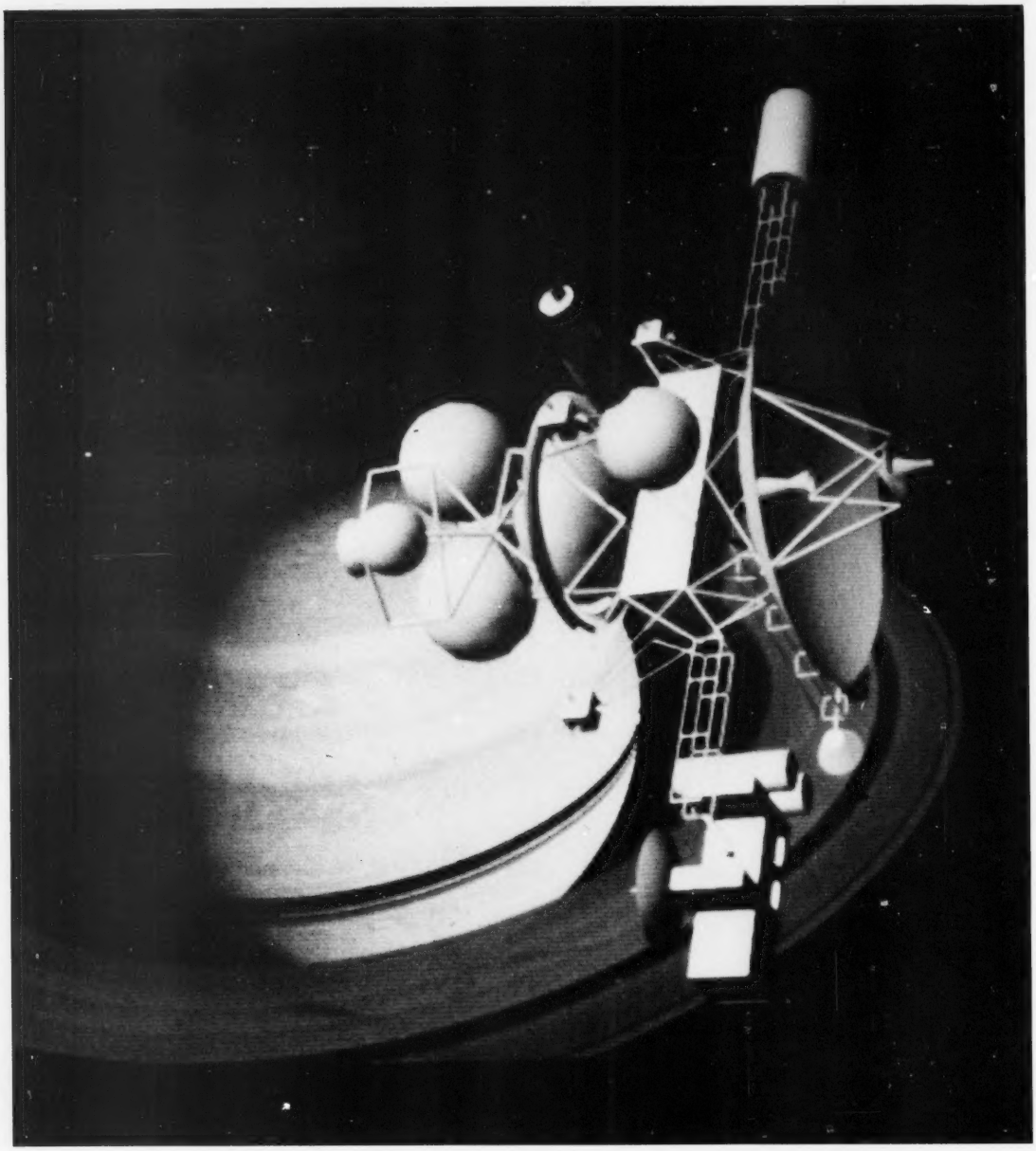
Name	Launch Date	Vehicle	Range	Mission Remarks
* IRAS	January 25	Delta	WSMC	Infrared astronomy. NASA scientific.
* NOAA-E	March 28	Atlas-F	WSMC	NOAA weather and SARSAT. Reimbursable.
* RCA-F	April 11	Delta	ESMC	RCA communications. Reimbursable.
* GOES-F	April 28	Delta	ESMC	NOAA weather. Reimbursable.
* Intelsat V-F	May 19	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
* EXOSAT	May 26	Delta	WSMC	European Space Agency. Reimbursable.
* Galaxy-A	June 28	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
* HILAT	June 28	Scout	WSMC	Air Force research and development. Reimbursable.
* Telstar 3-A	July 28	Delta	ESMC	AT & T communications. Reimbursable.
* RCA-G	August 25	Delta	ESMC	RCA communications. Reimbursable.
* Galaxy B	September 22	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
NAVY-21	December	Scout	WSMC	DOD transit. Reimbursable. Call up.

Note: At reader request, following is a brief explanation of terms used in the Launch Schedules: WSMC—Western Space and Missile Center, Vandenberg Air Force Base, Calif.; ESMC—Eastern Space and Missile Center, Cape Canaveral Air Force Station, Fla.; SMR—San Marco Range, off the east coast of Kenya, Africa; WFC—Wallops Flight Center, Wallops Island, Va.; KSC—Kennedy Space Center, Fla. *Reimbursable* expendable launches means that NASA is compensated or repaid for launch expenses incurred by the company or agency whose payload is launched. *Call up* indicates that the launch vehicle and spacecraft are in flight status and have been placed on standby, awaiting final preparations for launch based on the customer request for a launch time and date within a period of time not to exceed 120 days.

Space Shuttle Launches for 1983

Orbiter	Launch Date	Launch Number	Launch Site	Payload
* Challenger (OV-099)	April 4	6	KSC	TDRS-A
* Challenger (OV-099)	June 18	7	KSC	OSTA 2; SPAS-01 Telsat-F; Palapa B-1
* Challenger (OV-099)	August 30	8	KSC	INSAT 1-B; PFTA
Columbia (OV-102)	Nov. 28	9	KSC	Spacelab 1

* Successful launch



MARINER MARK II—The proposed spacecraft is being designed to accommodate instrumentation for a variety of possible exploratory missions to the planets, satellites, asteriods and comets. The spacecraft could be easily reconfigured for different missions. The mission depicted here would place a Mariner Mark II in orbit around Saturn to map the moon Titan in infrared and radio wavelengths during repeated close flybys of the moon.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent Office and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Hossein Bahiman, NASA/GSFC	Unidirectional flexural pivot	4,405,184	GSFC
Philip A. Studer, NASA/GSFC	Actively suspended counter-rotating machine	4,405,286	GSFC
George A. Coffinberry, General Electric Co., Cincinnati, Ohio	Apparatus for improving the fuel efficiency of a gas turbine engine	4,404,793	LeRC
Antal K. Bejczy, Caltech/JPL, Pasadena, Calif.	Optical fiber tactile sensor	4,405,197	NRO-JPL
Robert L. Altman, Ludwig A. Mayer, Alan C. King, San Jose State University San Jose, Calif.	Fire extinguishant materials	4,406,797	ARC
Richard F. Schmidt, NASA/GSFC	Focal axis resolver for offset reflector antennas	4,407,001	GSFC
Pierce C. Toole, Dennis M. McCarthy, Planning Research Corp., Kennedy Space Center, Fla.	Automatic level control circuit	4,406,989	KSC
Clarence E. Cook, Glynn E. Smith, Richard C. Monaghan, NASA/ARC	Inflatable device for installing strain gage bridges	4,407,686	ARC
Laurence J. Bement, James W. Bailey, LTV Corp., Hampton, Va.	Explosively activated egress area	4,407,468	LaRC
John R. Davidson, Joseph S. Heyman, NASA/LaRC	Error correction method and apparatus for electronic timepieces	4,407,589	LaRC
Peter O. Minott, NASA/GSFC	High speed multi-focal plane optical system	4,407,563	GSFC
Kenneth E. Wood, Rockwell International, Downey, Calif.	Apparatus for accurately preloading auger attachment means for frangible protective material	4,407,165	JSC
Lawrence R. Holland, Athens State College, Athens, Ala.	Apparatus and method for heating a material in a transparent ampoule	4,408,658	MSFC
John B. Tenney, Jr., Rochester General Hospital, Rochester, N.Y.	Prosthetic occlusive device for an internal passageway	4,408,597	MSFC
William N. Myers, Leopold A. Hein, NASA/MSFC	Resilient seal ring assembly with spring means applying force to wedge member	4,410,189	MSFC
Robert W. Rosser, Mark S. Taylor, San Jose University, Calif.	Fluoroether modified epoxy composites	4,410,682	ARC
Robert R. McWithey, Dick M. Royster, Thomas T. Bales, NASA/LaRC	Metal matrix composite structural panel construction	4,411,380	LaRC
William K. Koffell, Eugene N. Tuley, Charles H. Gay, Jr., Raymond E. Troeger, Albert P. Sterman, General Electric Co., Cincinnati, Ohio	Tip cap for a rotor blade	4,411,597	LeRC
Frederic S. Dawn, James V. Correale, NASA/JSC	Absorbent product and articles made therefrom	4,411,660	JSC

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Equipment Analysis

A radio unit (below) is undergoing vibration testing at Magnavox Government and Industrial Electronics Co., Ft. Wayne, Ind. In its research and development work, Magnavox has used the NASA Structural Analysis (NASTRAN)® computer program for vibration analysis of electronic equipment. The NASTRAN program, developed by Langley Research Center, Hampton, Va., and supplied by NASA's Computer Software Management and Information Center (COSMIC), is used by many companies in hundreds of industrial applications. It is a general purpose program which mathematically analyzes a design and predicts how it will stand up under the various conditions of stress and strain it will encounter in operational service. This permits engineers to study the structural behavior of many different designs before settling on a final configuration.

At Magnavox, the NASTRAN program was originally used in the design stage of heavy aluminum fixtures for vibration testing. Electronic components, such as chassis and printed circuit boards, are mounted on the fixture and vibrated to determine the amount of vibration they can withstand. The NASTRAN program is also used to compare the resonant frequencies of the chassis and printed circuitry to predict whether failures may occur because of high vibration levels. Engineers can then make design alterations to improve the equipment's vibration resistence.

®NASTRAN is a registered trademark of the National Aeronautics and Space Administration.

*NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

NASA
National Aeronautics and Space Administration